Tracheal Diverticula and Tracheobronchomegaly

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REPORTS OF DIVERTICULA OF THE TRACHEA AND THE FREQUENTLY ASSOCIATED TRACHEOBRONCHOMEGALEY HAVE BEEN PUBLISHED SPORADICALLY IN THE LITERATURE. TRACHEAL DIVERTICULA ARE RARE AND ARE FOUND MOST FREQUENTLY AS INCIDENTAL POSTMORTEM FINDINGS, ALTHOUGH SINGLE LARGE DIVERTICULA AND MULTIPLE DIVERTICULA ASSOCIATED WITH TRACHEOBRONCHOMEGALEY ARE OCCASIONALLY FOUND AT BRONCHOGRAPHY. VARIOUS CLASSIFICATIONS AND ETIOLOGIES HAVE BEEN SUGGESTED AND ARE SUMMARIZED BY SEVERAL AUTHORS.16 KATZ ET AL.6 HAVE PRESENTED A COMPREHENSIVE REVIEW OF THE SUBJECT, AND WE ARE ESSENTIALLY IN AGREEMENT WITH THEIR INTERPRETATION OF THE LITERATURE AND CLASSIFICATION.

FOUR TYPES OF TRACHEAL "DIVERTICULA" HAVE BEEN DESCRIBED: (1) RUDIMENTARY BRONCHUS; (2) CYSTIC DILATATION OF MUCOUS GLAND DUCT; (3) TRACHEOCELE "AERIAL GOITER"); (4) DIVERTICULUM ASSOCIATED WITH TRACHEOBRONCHOMEGALEY.

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Figure 1: (A) Case 1—Tracheobronchomegaly with tracheal diverticula. There is marked enlargement of the trachea and right main bronchus. The left main bronchus and peripheral bronchopulmonary tree appear normal. Multiple diverticula are seen extending from the right posterior tracheal wall (between the arrows).
Rudimentary bronchi are cylindrical "diverticula" which arise from the right posterior wall of the lower trachea. The largest, described from by Chiari, was 6 x 12 mm. These are very rare, apparently asymptomatic, and may be an incidental finding at bronchography or necropsy.

Cystic dilatation of mucous gland ducts are ovoid pedunculated or sessile cysts filled with viscous fluid. Generally, these measure less than 30 mm. in length and open to the trachea through small mouths less than 3 mm. in diameter. The common location is the right posterior wall of the upper trachea. Grossly, these cysts appear similar to paratracheal lymph nodes and cannot be demonstrated by usual roentgenographic studies due to their size and location. Since the tracheal openings are small and the fluid content viscous, it is unlikely that they will fill with contrast material. This may explain why they are not seen at bronchography, even though a 1 per cent incidence has been reported in consecutive unselected necropsies. Although associated with chronic or repeated inflammatory disease of the respiratory tract, they most likely do not produce symptoms.

A tracheocele typically presents as a single, large, air-containing sac which develops through a localized weakness in the right posterior tracheal wall. This may be formed by prolonged increase in intratracheal pressure from violent coughing or from an occupation involving excessive vocal or pulmonary effort. Such a diverticulum may present radiographically as a paratracheal or superior mediastinal air cavity, with or without an air-fluid level, and is easily outlined with contrast material. Symptoms are primarily related to the retained secretions which spill periodically into the respiratory tract.

**Figure 1:** (B) Lateral view shows posterior protrusion of the diverticula.
Wide-mouth diverticula may be seen with tracheobronchomegaly, a condition believed to be congenital\(^1\) and characterized histologically by poorly developed elastic and muscle tissue in the walls of the trachea and/or major bronchi.\(^4,11\) The diverticula, if present, may arise anywhere in the weakened wall, but predominantly in the right posterior region and vary markedly in size and number. The large trachea can be identified on plain films of the chest, while bronchography outlines the large redundant trachea and bronchi as well as any associated diverticula. Severe symptoms of tracheobronchitis may be present, but the diverticula appear to be asymptomatic unless one should enlarge sufficiently to cause pressure on surrounding structures or retain secretions.\(^1\)

The tendency for the formation of diverticula in the right posterior tracheal wall may be due to the inherent weakness between the bands of trachealis muscle where they join the tips of the tracheal rings.\(^6\) The esophagus supports the left posterior tracheal wall discouraging diverticula formation on this side.

Cystic dilatation of the mucous gland ducts and tracheoeoles may be associated with normal size or mildly enlarged trachea, but the enlarged trachea is not a striking feature. There may be no other radiographically demonstrable pathology of the respiratory system.

However, tracheobronchomegaly as described by Katz et al.\(^*\) and others appears to be a different pathologic entity, the trachea typically approaching twice or more the normal diameter. In addition, the walls are irregular and tend to collapse on expiration. In published descriptions of the radiographic findings, bronchiectasis or other evidence of degenerative or chronic inflammatory disease of the lungs is very common. Thus, it has appeared that the tracheobronchomegaly may be a result of the chronic pulmonary disease, or the etiologic factors producing tracheobronchomegaly may actually involve the entire respiratory tract. It has also been suggested that the symptoms may not be related to the tracheal lesions, but rather to the peripheral pathology.\(^*\)

The purpose of this paper is to present a case which demonstrates megaly of the trachea and right main bronchus with tracheal diverticula, but without evidence of chronic disease in the distal respiratory tract. This suggests that, at least in some cases, tracheobronchomegaly is a separate disease entity and the changes in the peripheral respiratory tree are secondary to the tracheobronchitis associated with tracheobronchomegaly. The tracheobronchitis also appears to be the direct cause of this patient's symptoms. This is further supported by the bronchographer's note that a "profuse bronchorrhea" interfered with his study.

**Case Reports**

**Case 1**

This 28-year-old white law student was first admitted to UCLA Hospital on October 7, 1955 with a two-day history of a "headcold" characterized by right frontal headache, rhinitis and one day of increased cough productive of a half cup of thick, yellowish sputum. He also noted

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**FIGURE 1:** (C) Left anterior oblique view demonstrates the diverticula as seen on end. Enlargement of the trachea and right main bronchus is well seen in this projection.
fever and chest pain with deep respiration described as "irritation of my windpipes."

He was raised on farms in Nebraska and Iowa and had a long history of respiratory tract infections as follows: pre-school age, frequent "colds;" age five years, "pneumonia;" six years, "whooping cough;" eight years, "tonsillectomy;" grade school years, frequent "colds" associated with fever and night sweats and sometimes requiring two to three weeks of bedrest; and age 15 years, acute "sinusitis" which required nasal irrigation and suction. He has since had "chronic sinusitis" which is exacerbated by respiratory infections and associated with headaches, a post-nasal drip, and an increase in "colds" and "strep throats." At age 22, while in the Army, he was hospitalized for acute respiratory illness characterized by fever, chest pains, and productive cough. The acute symptoms responded well to treatment, but productive cough persisted for eight weeks. Although previously asymptomatic between the acute respiratory infections, he now retained chronic morning cough productive of brownish sputum. With respiratory infections, the sputum increased in amount and became yellowish, but responded well to antibiotics.

His past history includes "hives" characterized by facial edema and pruritic body rash of four or five months' duration at age 14 years. At age 17, he had mumps orchitis. Since age 21 he has noted asymptomatic rashes about the neck when "tense." Family history disclosed that his father was always "very susceptible to colds" and had "part of his lung" removed as a young adult. His mother and one sister were living and well, but one brother died at one year of age.

Physical examination was not remarkable except for discrete, movable, non-tender lymph nodes noted in the neck, axillary, epitrochlear, and inguinal regions, the largest being 2 cm. in diameter. The mucosa of the upper respiratory tract was moderately injected, but the lungs were clear to percussion and auscultation. Chest x-ray films (posterior-anterior and lateral) obtained on admission and five days later were negative. Marked symptomatic improvement was noted in 24 hours with penicillin and supportive therapy. Subsequent skin tests for coc-

Figure 2: (A) Case 2—Tracheobronchomegaly with bronchiectasis. The trachea and both main stem bronchi are enlarged. There is bronchiectasis in both lower lobes, more marked on the left.
candididomycosis, histoplasmosis, and tuberculosis were negative.

A left bronchogram was obtained on February 2, 1956 and a right bronchogram on October 5, 1956. Both revealed marked enlargement of the trachea and right main bronchus along with diverticula of the right posterior wall of the upper trachea (Fig. 1). The trachea measured 32.0 mm. in its widest diameter, while the right main bronchus measured 23.0 mm. These dimensions are similar to the cases of tracheobronchomegaly reported by Katz et al. and show marked enlargement when compared to their measurements for 50 consecutive unselected bronchograms (Table 1). The diameter of the left main bronchus in the present case was 15.0 mm. The upper trachea deviated to the left on the bronchogram and laminograms confirmed this impression. However, no mass could be demonstrated in this area radiographically or on physical examination. When last seen in our clinic in 1957, this patient was asymptomatic except for the chronic cough.

A second patient manifested more typical findings associated with tracheobronchomegaly. This case did not demonstrate diverticula although a suggestion of early diverticulum formation was seen in one area (see arrow, Fig. 2D). Bronchography revealed saccular bronchiectases of the lower lobes, mostly on the left, and this appeared responsible for his major symptomatology.

**Case 2**

A 42-year-old white non-smoker was admitted to Holy Cross Hospital* on August 21, 1964 for elective lobectomy. He had a history of "frequent colds" as a child, a chronic cough for most of his adult life, and repeated respiratory infections associated with chills, fever, and productive cough during the last two years. These were diagnosed as "bronchitis" and "bronchopneumonia" and responded to antibiotics. On admission, his only symptoms were chronic weakness and productive cough; his medical history was otherwise unremarkable. Significant physical findings were limited to rales at both lung bases, greater on the left.

Bronchography revealed enlargement of the trachea and both main stem bronchi (Table 1). Saccular bronchiectasis was seen in both bases, but mostly in the left posterior basal segment (Fig. 2).

Left lower lobectomy was performed and the pathologic specimen revealed marked bronchiectasis along with multiple areas of acute focal pneumonia. The patient did well postoperatively with only minimal residual cough.

**Summary**

Four types of tracheal diverticula are briefly described.

Only one of these is associated with marked tracheobronchomegaly. Such a case is described. Unlike most cases of tracheobronchomegaly previously reported, this patient had no radiographic or clinical evidence of disease distal to the main stem bronchi; the tracheobronchitis was the only demonstrable cause for his symptoms. This case supports the concept that tracheobronchomegaly is a localized, congenital lesion, which results in chronic tracheobronchitis.

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**Table 1—Comparison of Measurements from Cases 1 and 2 to Those of 50 Consecutive Bronchograms Reported by Katz et al.**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Mean Plus 3 Standard Deviations</th>
<th>Case 1</th>
<th>Case 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trachea</td>
<td>20.2 mm.</td>
<td>30.5</td>
<td>32.0</td>
<td>31.0</td>
</tr>
<tr>
<td>Right main bronchus</td>
<td>16.0</td>
<td>24.0</td>
<td>23.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Left main bronchus</td>
<td>14.5</td>
<td>23.0</td>
<td>15.0</td>
<td>24.0</td>
</tr>
</tbody>
</table>

Measurements were made at the largest diameter and recorded in mm.
This chronic infection may eventually spread to the distal pulmonary tree producing bronchiectasis, bullous emphysema, and fibrosis.

A second case of tracheobronchomegaly with findings more typical of cases previously reported is briefly presented. This patient demonstrated bronchiectasis and chronic pulmonary infection, but no tracheal diverticula.

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RESUMEN

Cuatro tipos de divertículos traqueales son brevemente descriptos. Solamente uno de ellos aparece asociado a la tracheobroncomegalia pronunciada.

Uno de estos casos es reportado. A diferencia de la mayoría de los casos de tracheobroncomegalia publicados hasta ahora, este sujeto no tenía indicios clínicos ni radiológicos de alteraciones patológicas mas allá de los bronquios primarios, siendo la tráqueo-bronquitis la única causa aparente de sus síntomas. Este caso reafirma el concepto de que la tracheobroncomegalia es una lesión congénita localizada que da origen a traqueo-bronquitis crónica. Esta afección crónica puede extenderse a las ramas distales dando lugar a bronquiectasias, fibrosis y enfisema buloso.

Un segundo caso de tracheobroncomegalia es objeto de breve descripción. El paciente presentaba bronquiectasias e infección pulmonar crónica, pero no los divertículos traqueales típicos de los casos previamente reportados.

RESUMÉ

L’auteur décrit brièvement quatre types de diverticules de la trachée.

Un seul d’entre eux s’associe à un mégatrachéobronche net. L’auteur en fait la description. Contrairement à la plupart des cas de mégatraceo-bronche rapportés jusqu’à présent, la malade n’avait pas de manifestation évidente d’une altération à distance des bronches principales.

Cette observation est un élément en faveur de la conception que la mégatrachéobronche est une maladie congénitale et localisée qui peut être à l’origine d’une trachéo-bronchite chronique. L’infection chronique peut éventuellement se répandre vers les bronches distales et être alors à l’origine de dilatation des bronches, de bulles d’emphyème et de fibrose.

L’auteur rapporte rapidement un deuxième cas de mégatraceobronche. La malade était atteint de dilatation des bronches et d’infection pulmonaire chronique mais n’avait pas de diverticule trachéal.

Figure 2C

(C) Left anterior oblique view shows the irregular enlargement of the trachea. (D) Right anterior oblique view. The arrow indicates a small accumulation of contrast material in the right posterior tracheal wall suggestive of early diverticulum formation.
ZUSAMMENFASSUNG


REFERENCES

COMMON ATRIUM WITH LEFT SUPERIOR CAVA

A case in which a persistent left superior vena cava drained into the left side of a common atrium is described. Surgical repair of the lesion included the creation of a new inflow into the right atrium from the left superior vena cava by constructing a tunnel out of the posterior wall of the left atrium and then reconstructing the interatrial septum with a periatrial patch. The patient is well eight months after operation.


CONTROLLED HYPOTENSION FOR TREATMENT OF ACUTE LUNG EDEMA

For the treatment of acute pulmonary edema in 20 patients suffering from cardiac failure, cardiogenic shock, and severe systemic disease, the authors used controlled hypotension with a ganglionic blocking agent, trimethaphan carbamol sulfonate (Arfonad). A stable positive effect was achieved in 16 cases. In ten patients, controlled hypotension was utilized after ineffective treatment with other agents. Signs of pulmonary edema disappeared five to ten minutes after the institution of intravenous drip administration of 0.1 per cent (Arfonad) solution and the arterial pressure dropped down to 70-80 mm.Hg. The introduction of Arfonad was discontinued after the disappearance of clinical signs of pulmonary edema. Controlled hypotension is a very effective means of controlling acute edema of the lungs and it should be widely used in the clinical practice.